TRANSACTION COST AND THE SMALL STOCK PUZZLE: THE IMPACT OF OUTLIERS IN THE NYSE

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Abstract
In this article we study the effect of transaction costs on asset prices. We examine the characteristics of the actual extreme performers (Outliers), their stock prices, and transactions cost and link them to firm size. The analyses is based on data from the COMPUSTAT tapes with valid data for the bid and ask prices and the CRSP samples of all firms listed in the NYSE, AMEX, and NASDAQ during the period 1970-2000. Once transaction costs are taken into account, no positive abnormal returns are found for small firms. Transaction costs account fully for both the abnormality and the recent size discountability.

JEL classification: G12,G14
Keywords: Outliers, Transaction Costs, Size discount

1. Introduction.

The classical analyses of Sharp (1964), Lintner (1965), and Mossin (1966) ignored trading volume and transaction cost in pricing assets. In a world of uncertainty transaction costs and taxes exists. An important component of the transaction costs faced by investors in financial securities is the bid-ask spread set by market makers.[1] Empirical studies of the proportional bid-ask spread have shown that it varies inversely with price per-share, firm size and a measure of trading activity, such as volume, and varies directly with a measure of risk such as return variance (see, Grant and Whaley, 1978, and

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[1] Transaction costs include not only the spread between bids and offers but the brokerage fees and transfer taxes. For the sake of this study all transaction costs other than the bid-ask spread are ignored.

Stoll, 1978a). Explicit consideration of the dealer's bid-ask spread is needed to determine if excess returns are obtainable for typical investors. Obviously, since rates of return are measured before transaction costs, it is necessary to adjust rates of return by transaction costs. Blume and Stambaugh (1983) argue that the bid-ask spread creates a significant upward bias in mean returns calculated with transaction prices.

Transaction costs have bean proposed as an explanation for two main puzzles, the equity premium puzzle of Mehra and Prescott (1985) and the small stock puzzle of Banz (1981) and Reinganum (1981). Their work calls into question the efficient market hypothesis, and has spawned hundreds of subsequent studies. Equity premium puzzle of Mehra and Prescott (1985) states that the average excess return on the US stock market is too high to be easily explained by standard asset pricing models. Small stock puzzle on the other hand, is the result that low market capitalization firms have higher sample mean returns than would be expected if the market portfolio was mean-variance efficient.

In this paper we test for the size effect after adjusting for transaction costs, sample of the study, and sample size and the effect of outliers. Evaluating the effect of trading costs on market value might explain the small firm discount. One can ask what is new about this. This paper contributes to the literature by utilizing a new sample that includes the largest and smallest firms in the United States, it adds also by examining larger sample size to include the last thirty years. Moreover, this study differs from other related studies in that it concentrates only on testing outliers. Recent evidence by Fama and French's (1995) shows that part of the failure to detect the low returns for small firms may be masked by a handful of outliers in the smaller size deciles. To examine the impact of outliers on the average monthly returns, we report the total number of monthly firm returns of the largest and smallest size deciles listed in the NYSE, AMEX, and NASDAQ.

The rest of the paper is organized as follows. In section 2 data is discussed. Section 3 reports the average monthly returns for NYSE,

AMEX, and NASDAQ firms. Section 4 explains the methodology and section 5 concludes.

2. Description of the Data

The data consists of all New York Stock Exchange (NYSE), American Stock Exchange (AMEX), and NASDAQ operating firms listed on the Center for Research in Security Prices (CRSP) daily tapes on the last day of a calendar year during 1970-1999. The aggregate sample includes more than 160,000 firm years. Monthly percentage returns series on ten size-based portfolios (denoted by dec1, dec2, …, dec10, respectively) were obtained for the 2001 CRSP index tape. Dec1 is an equal-weighted portfolio of the smallest decile of stocks traded in the NYSE/AMEX/NASDAQ, dec2 is an equal-weighted portfolio of the second decile, …, and dec10 is an equal-weighted portfolio of the stocks of the largest decile of firms.

In addition, the monthly percentage return of an equal-weighted market proxy is obtained from the same data tape and the one-month Treasury bill is obtained by calculating the one month holding period return using the three month treasury bill rate from the federal bank of St. Louis database.

From this dataset, the monthly excess returns of the ten size–based stock portfolios and the market index are constructed by subtracting from their monthly returns the one-month treasury-bill rate, under the assumption that it represents riskless returns. In addition, monthly stock returns (dividends plus capital gains) for the largest 11 and the smallest 10 firms listed in the S&P500 composite and their bid-ask prices are gathered from the same source. For each firm, out-of-pocket costs (even though commission costs are ignored here) are collected for the last trading day of each year. The proportional spread represents compensation to the dealer on a turn-around transaction. On a single transaction, the cost to the investor is one half the spread.

3. Average monthly returns for NYSE, AMEX, and NASDAQ firms

Following the conventional analysis of the size effect, Tables 1 present the equally weighted average monthly returns for all firms across size deciles during 1970-1999, and 1970-2000. Each month, all firms are equally weighted within the size deciles.

Table 1 reports the average daily returns. The average daily returns for the smallest size decile is 0.063% compared to 0.05% for the largest size decile during the 1970-1999 period. Thus the small firms return (SML in the Table 1) is 0.013% higher than large firms. For each decile, the standard error of the average daily return, which is given in parenthesis, is the standard deviation of 7834 daily averages.

Several interesting results emerge from Table 1. First, large firms become riskier in the 1980-1990 period with a standard deviation of 0.0095 compared to 0.0065 for the smallest size decile. Over this period, the small firm premium is negative (–0.115%). with the largest size decile having an average daily return of 0.066% compared to 0.055 for the smallest size decile (the small differences in the subtractions results are caused by rounding). Second the difference between small and large firms is decreasing across time, with the lowest levels in the eighties. Third, on average, risk is increasing monotonically with firm size in both the 1980-1990 and 1990-1999 periods. Fourth, consistent with the previous literature, in columns 2 and 5, risk and size are directly related with the smallest size decile outperforming the largest size deciles on a risk-adjusted basis.

The general conclusion from table 1 is that the size effect is weakening over time and reverses into a discount in the eighties. This result might be justified by the fact that arbitrageurs, in learning about the profitable opportunity, trade in such a way that it no longer remains profitable and since these profitable trades are not persistent, then this supports the efficient market hypothesis.

Table 1. Average monthly percentage returns: Amex, and NASDAQ firms categorized by size deciles, 1970-2000**.**

Size deciles	Average daily return (%) 1970-1980	Average daily return (%) 1980-1990	Average daily return (%) 1990-1999	Average daily return (%) 1970-1999
Small	1.60(0.092)	1.33(0.067)	2.02(0.066)	1.51(0.088)
2	1.31(0.082)	1.01(0.063)	1.37(0.058)	1.09(0.082)
3	1.10(0.079)	1.09(0.092)	1.33(0.053)	1.04(0.081)
4	1.20(0.077)	1.02(0.0597)	1.15(0.050)	0.98(0.079)
5	0.97(0.073)	1.06(0.059)	1.29(0.051)	0.97(0.080)
6	1.04(0.071)	0.23(0.056)	1.21(0.512)	0.98(0.078)
7	0.92(0.0679)	1.27(0.057)	1.25(0.049)	1.01(0.077)
8	0.96(0.063)	1.41(0.056)	1.27(0.049)	1.07(0.076)
9	0.82(0.058)	1.42(0.053)	1.32(0.046)	1.05(0.075)
Large	0.54(0.0465)	1.41(0.047)	1.47(0.039)	0.98(0.072)
SML	1.06(0.077)	-0.072(0.052)	0.55(0.064)	0.51(0.070)

The average monthly return equally weights each of the 361 months during the 31-year period. The standard errors from the monthly return time-series are in parentheses.

4. Methodology

We proceeds and re-examine the size effect after adjusting for transaction cost to test whether the transaction costs can at least partially or totally account for the large firms' abnormality. In order to do so we concentrate after this point on a sample of outliers where we form two equally weighted large and small portfolio. In the next section the effect of transaction costs on these outliers is examined.

4.1. Transaction costs and firm size:

To examine whether transaction costs account for the size effect, data were collected for transaction costs to determine whether differences according to firm size can explain the small firm effect. Bid and ask prices were collected for the 11 largest and 10 smallest

firms listed in the S&P500 composite[2]. Because the S&P 500 is weighted by market capitalization, the largest companies have always dominated it. The twelve largest companies in the S&P500 are: General Electric, Microsoft, Coca-Cola, Exxon, Merck, Intel, Royal Dutch Petroleum, Pfizer, Procter &Gamble, Philip Morris, Citicorp Inc., and American International Group. The monthly proportional spread, calculated as

$$\frac{askprice - bidprice}{(askprice + bidprice)/2}$$

the ask price is the highest closing price during each month while the bid price is the lowest closing price during each month. For each stock, the difference between the closing ask and bid prices is divided by the average of the ask and bid prices to determine the stock's proportional spread. This proportional spread represents compensation to the dealer on the round-trip transaction costs. On a single transaction, the cost to the investor is one-half the spread.

To illustrate the relationship between market value and transaction costs during the sample period, the mean percentage spread on the 11 largest stocks was computed. Firms' market value is in ascending order. The results are reported in Table 2. In general, the relative spread decreases as the market value of each stock increases. On average, percentage transaction costs increased in the 1980-1989 period (compared to the base of the seventies) by 2.8%, and in the 1990-2001 period by 43.4%. Row 5 of Table 2 reports that prior to 1981, percentage transaction costs averaged 0.11% per month compared to 0.131% after 1981. The average percentage spread of all the firms grows at 19.1% per month.

Moreover, to illustrate the relationship between market value and transaction costs during the sample period, the mean percentage spread on the 10 smallest stocks was computed. First, we gather a sample for each year in the study period consisting of all firms from

[2] We exclude a number of small and large companies due to the small number of observation involved.

the COMPUSTAT tapes with valid data for the bid and ask prices. Second, we form samples consisting of the intersection of my COMPUSTAT samples and the CRSP samples. Third, the firms' market values are arranged in ascending order. Only firms with a market value of less than $5 million are considered, and the smallest 10 firms are taken from this group. Forth, the mean percentage spread on the stocks for each firm in each year is computed. The results are reported in Table 2.

In general, the relative spread rate decreases as the market value of the stocks for each firm increases. In addition, consistent with previous evidence, transaction costs are higher for the smaller firms. Finally, on average, there is a 37% decrease in the average 10 firms' transaction costs in the eighties compared to the base years of the seventies, while transaction costs increased by 1.3% in the nineties compared to the base.

Table 2.1
Mean percentage transaction cost rate of the 11 largest stocks and the 10 smallest stocks in the S&P500 composite.
Firms are listed in ascending order of total market capitalization of the stock. The abbreviations are the ticker numbers.

Firm Ticker	C	RD	JNJ	AIGR	MO	PF	KO
1970-2001	0.15	0.081	0.098	0.11	0.15	0.18	0.15
1970-1979	0.15	0.072	0.079	0.12	0.092	0.10	0.089
1980-1989	0.16	0.093	0.11	0.11	0.10	0.097	0.091
1990-1999	0.13	0.76	0.10	0.09	0.26	0.33	0.26
1970-1981	0.16	0.079	0.091	0.11	0.092	0.10	0.089
1982-2001	0.14	0.08	0.10	0.10	0.10	0.19	0.22
Firm Ticker	Burt	Fwtr	San	Natl	Btb	Sdp	Pogob
1970-2001	0.42	0.70	7.13	0.76	0.19	0.66	0.23
1970-1979	0.21	0.26	9.01	0.22	0.19	0.16	0.44
1980-1989	0.23	0.79	3.4	0.92	0.18	0.79	0.16
1990-1999	1.11	0.97	14.5	0.95	0.20	0.89	0.17
1970-1981	0.24	0.26	7.0	0.21	0.19	0.16	0.36
1982-2001	0.51	0.94	7.2	1.052	0.19	0.94	0.16

[a] Avg is the mean percentage transaction costs of the listed firms. [b] The percentage change in the proportional transaction costs from the seventies

Tabla 2.2.

Firm Ticker	MRJ	INTC	XOM	GE	Avg [a]	% Δ [b]
1970-2001	0.098	0.17	0.079	0.09	0.123	
1970-1979	0.095	0.19	0.085	0.089	0.106	
1980-1989	0.095	0.17	0.087	0.095	0.109	0.028
1990-1999	0.10	0.15	0.066	0.087	0.152	0.434
1970-1981	0.093	0.19	0.09	0.087	0.11	
1982-2001	0.18	0.10	0.12	0.074	0.131	0.191
Firm Ticker	Gcn	Sun	FCMB			
1970-2001	0.12	0.11	0.09		1.041	
1970-1979	0.14	0.09	0.055		1.077	
1980-1989	0.12	0.12	0.09		0.68	-0.37
1990-1999	0.10	0.09	0.11		1.091	0.013
1970-1981	0.13	0.12	0.07		0.874	
1982-2001	0.12	0.10	0.10		1.131	0.29

To evaluate the effect of trading costs on the market value anomaly, the two-parameter CAPM is assumed to apply to after-transaction costs returns. We formed two equally weighted portfolios. The monthly returns of each of the stocks in each of the portfolios during the period January 1970 through December 1999 are adjusted to incorporate transaction costs by applying the following formula:

$$R_{jt} = (1+R_{jt})(1-BAS_{jt}) \Big/ (1+BAS_{jt}) - 1, \qquad (3)$$
$$t = 1,....,360,$$

Where R_{jt} denotes the after-transaction cost rate of return on portfolio j in month t, and BAS_{jt} is the proportional transaction cost for portfolio j during month t, obtained by summing one half the percentage bid-ask spread for the stock j. Then, we construct an arbitrage portfolio containing stocks of very large and very small firms, by combining long positions in small firms with short positions in large firms.

According to Banz (1981), this approach has the advantage that no assumptions about the exact functional relationships between market value and expected return need to be made. The procedure involves (a) the calculation of the difference in raw returns in each month, and (b) running time series regressions of the difference on the excess returns of the equally weighted market index.

The intercept terms of these regressions are then interpreted as arbitrage returns from holding the smallest firms long and the largest firms short. More specifically, the intercept represents the zero net investment in a zero beta portfolio. The abnormal performance measures from the regressions are reported in Table 3. Panel (a) shows that large firms outperform small firms by 0.17 and 0.014 for the periods 1990-1999 and 1982-1999, respectively. When portfolios are adjusted for transaction costs, the market value effect is reversed. This result holds across all time periods.

Overall, ignoring transaction costs can account for the abnormal returns earned by an investor who can direct his investments in low market caps or low price per share stocks before the 1981. And it account for the difference between small and large firms after this point. This may lead us to adopt the assumption of Dimson and Marsh (1999) that the size effect is the tendency of small-cap stocks to perform differently from large-cap stocks.

The Table 3, Before- and After-Transaction Cost Excess Returns
Mean monthly returns on arbitrage portfolios[a] are calculated using the following equation:

$$R_j - R_k = \hat{a}_i + \hat{b}_i \left(R_m - R_f \right)$$

This table illustrates the before- and after-transaction cost excess returns for two equally weighted portfolios. All regressions are Newey-West hetroskedasticity consistent standard error and covariance. P-values are in parentheses.

Table 3
Before- and After-Transaction Cost Excess Returns

	Panel a Before transaction cost	Panel b After transaction cost	% Δ^b (large)	% Δ^c (small)
	$\hat{a}$	$\hat{a}$		
1970-1999	-0.0044 (0.37)	-0.110*** (0.00)		
1970-1979	0.0014 (0.86)	-0.083*** (0.00)		
1980-1989	0.0010 (0.91)	-0.092*** (0.00)	0.028	-0.37
1990-1999	-0.017*** (0.03)	-0.154*** (0.00)	0.43	0.013
1970-1981	0.0068 (0.37)	-0.080*** (0.00)		
1982-1999	-0.014*** (0.02)	-0.131*** (0.00)	0.19	0.29

[a] Equally weighted portfolios with 21 securities, adjusted for the differences in market risk and bid-ask spread, with respect to CRSP equally weighted index. p-values are parentheses. [b] The percentage change in the proportional transaction costs from the seventies for the largest 11 firms. [c] The percentage change in the proportional transaction costs from the seventies for the smallest 10 firms.

Dimson and Marsh (1999) show that small firm capitalization effects have gone into reverse in the UK market with a small-cap discount around 6%. They suggest that the reversal resulted from a change in fundamentals, not just a "change in sentiment". Dimson and Marsh made an important observation, they claim that the size premium has gone into reverse but the size effect lives on. In other words, they suggest that the size effect refers to the tendency for small-cap stocks to perform differently from large-cap stocks. If this is the case, all stock market regularities can be explained in similar logic, so if the January premium will ever reverse into a discount, such evidence will not be against its existence but will be evidence of

changes in fundamentals. While the first part of the results is consistent with those of Stoll and Whaley (1983), it further confirms that transaction costs account fully for the abnormality.[3]

5. Conclusion

A number of researchers who have examined the size effect did not consider transaction costs when analyzing the predictable changes in stock prices. This paper evaluates the effects of trading costs on market value to explain the small firm effect. We examine the characteristics of the actual extreme performers (Outliers), their stock prices, and transactions cost and link them to firm size.

The analyses is based on data from the COMPUSTAT tapes with valid data for the bid and ask prices and the CRSP samples of all firms listed in the NYSE, AMEX, and NASDAQ during the period 1970-2000. Once transaction costs are considered, no positive abnormal returns are found for small firms. Transaction costs account fully for both the abnormality and the recent size discountability. In this we support the claim by Dimson and Marsh (1999) that the size effect refers to the tendency for small-cap stocks to perform differently from large-cap stocks. Such evidence will not be against its existence but will be evidence of changes in fundamentals.

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[3] Stoll and Whaley (1983) on the other hand reports that transaction costs partially account for the abnormality.

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